* **Matter**
  + Anything that occupies space & has weight
  + State can be changed by heating or cooling
  + Pure Substance
    - A material made of one type of matter
* **States of Matter**
  + Solid
    - Definite size & shape
    - Hard or soft
    - Ex: Wood, Iron, glass, ice, rubber, wool, butter
  + Liquid
    - Definite size
    - No definite shape—depends on the shape of container
    - Ex: Water, milk, alcohol, blood, oil, gasoline
  + Gas
    - No definite size or shape
    - Spreads to fill the size and shape of a container
    - Ex: Air, oxygen, carbon dioxide, ammonia
  + Plasma
    - Formed when gas is heated to extremes
    - Highly ionized
    - 99% of the universe is in the plasma state
* **Gravity**
  + Every body in the universe has a gravitational pull on every other body
  + Earth’s gravity pulls on every object around the Earth
  + The bigger the object, the greater the pull of gravity
  + Distance between two objects decreases their pull of gravity on one another
* **Weight**
  + The measure of the pull of gravity is called *weight*
  + Center of Gravity: the point at which all of the weight of the body seems to be located
  + Weight changes depending on the distance from the center of the Earth
* **Mass**
  + The amount of matter in a body is called its *mass*
  + A measure of the body’s inertia (the tendency of a body at rest to stay at rest & a body in motion to stay in motion)
* **Physical Properties**
  + Properties that can be observed with the five senses
  + Ex: Color, odor, taste, density, hardness, brittleness, elasticity, etc.
* **Chemical Properties**
  + Qualities or characteristics that have to do with its tendency to undergo chemical change
  + Ex: Air and moisture act on iron to make rust; vinegar acts on baking soda to produce bubbles of carbon dioxide gas
* **Physical Change**
  + Only the physical properties or characteristics of a substance are changed
  + It remains the same substance
  + Ex: Size, shape, heated, cooled, change in form or state
* **Chemical Change**
  + A new substance is formed with new physical and chemical properties than the original
  + Ex: Burning, rusting, tarnishing, souring of milk, digestion
* **Molecules**
  + The smallest particle of a substance that is still that substance, having all the properties of that substance
  + Movement:
    - Molecules of a Gas: Move quickly; are very far apart
    - Molecule of a Liquid: Move more slowly; are closer together
    - Molecule of a Solid: Very close together; vibrate back and forth
  + Cohesion
    - The attraction that molecules of the same substance have for each other
    - Allows molecules to come together to form the physical states of matter
    - **Solid**: Very strong attraction; holds shape
    - **Liquid**: Weaker attraction; sticks together
    - **Gas**: Very weak attraction; molecules move away from each other and spread throughout the container
  + Adhesion
    - Makes it possible for two different substances to stick together
    - Ex: Water sticks to materials and makes them wet; glue, cement, and paste; water in a drinking glass does not overflow
* **Atoms**
  + Particles smaller than molecules
  + Create molecules with one or more atoms
  + Composition of an Atom
    - Electron: negative electrical charge
    - Proton: positive electrical charge
    - Neutron: neither a positive nor negative electrical charge
    - Nucleus: The center of the atom that stores neutrons and protons & contains binding energy
    - Energy Levels: Sort electrons around the nucleus
    - Atoms mostly contain empty space
* **Elements**
  + Each type of atom is called an element
  + 92 naturally exist
  + >17 have been man-made
  + Use symbols for identification
  + Metals:
    - Metallic Luster
    - Conduct electricity and heat well
    - Many are ductile & malleable
  + Nonmetals:
    - Conduct electricity and heat poorly
    - Are not ductile or malleable
  + Metalloids:
    - Contain properties of both
* **Atomic Structure**
  + Protons and neutrons inside the nucleus
  + Electrons outside the nucleus
  + Seven shells (energy levels) for electrons to occupy
  + Atomic Number: The number of protons in the nucleus and electrons outside the nucleus of an atom
  + Atomic Mass: The combined mass of all the electrons (0), protons (1), and neutrons (1) in the atom
  + Isotopes: Atoms of an element that have the same atomic number but a different atomic weight
* **Compounds**
  + A substance made up of two or more elements that have combined in such a way that each element has lost its own special physical and chemical properties
  + Chemical change creates a new substance
* **Mixtures**
  + A substance made up of two or more elements or compounds that have combined in such a way that each element or compound has *not* lost its own special physical and chemical properties
  + Can be separated and returned to original form
* **Formulas**
  + The symbols and numbers that show the makeup of a compound
  + Formulas tell us:
    - What elements are in the compound
    - How many atoms of each element are in a molecule of the compound
* **Types of Chemical Changes or Reactions**
  + Combination Reaction
    - Two or more elements or compounds combine to form a larger and more complicated compound
  + Decomposition Reaction
    - A compound is broken up into the elements that formed it, or into simpler compounds
  + Simple Replacement Reaction
    - A free element replaces another element from a compound
  + Double Replacement Reaction
    - An element in one compound trades places with an element in another compound, and the result is two new compounds
* **Types of Chemical Reaction Demonstrations**
  + Combination
  + Decomposition
  + Replacement
  + Double Replacement
* **Solution Definitions**
  + Dilute solution- a small amount of solute dissolved in the solvent
  + Concentrated solution- a large amount of solute dissolved in the solvent
  + Saturated solution- much solute is dissolved in the solvent at a certain temperature and pressure
* **Types of Solutions**
  + Solid dissolving in a liquid
  + Gas in a liquid (CO2 under pressure to form soda water)
  + Gas in a gas ( air gasses spreading evenly and equally apart)
  + Liquid in a liquid ( alcohol and water)
* **Mixing Definitions**
  + Soluble- when a solid can dissolve in a liquid
  + Insoluble- a solid does not dissolve in a liquid
  + Miscible- when two liquids mix to form a solution
  + Immiscible- two liquids that cannot mix to form a solution
* **Take Note**
  + Solids dissolve better in hot liquids than in cold liquids
  + Gasses dissolve better in cold liquids than in hot liquids
  + An increase in pressure makes a gas more soluble in a liquid
  + There are three ways for solids to dissolve more quickly in liquid
    - Stirring
    - Powdering
    - Heating
* **Law of Conservation of Matter**
  + In ordinary chemical reactions, matter is neither created nor destroyed but only changed from one form to another
* **Energy Definitions**
  + Thermal energy- produced by the kinetic energy of molecules
  + Electrical energy- energy of electrons as they transfer through a substance
    - Electrical current- the flow of electrical charge, not the flow of electrons
  + Wave energy- travels in waves
    - Sound energy- produced when matter is moved back and forth, or vibrates, rapidly
    - Radiant energy- light rays, X-rays, radio waves, infrared rays, and ultraviolet rays
  + Chemical energy- form of potential energy that stores electricity in the substance
  + Nuclear energy- when an atom splits in two or when the nuclei of atoms fuse together

* **Law of Conservation of Energy**
  + Energy is neither created nor destroyed but only changed from one form to another
* **Take Note**
  + According to Albert Einstein, energy and matter are equivalent.
  + The law of conservation of matter and energy
    - Matter can be transformed into energy and energy can be transformed into matter
    - Matter can be destroyed but comes back as a created energy
    - Energy can be destroyed but comes back as a created matter
* **Natural Radioactivity Definitions**
  + Radioactivity- elements that give off invisible radiations (uranium, thorium, carbon-14, potassium-40, radon, and radium
  + Alpha particles- the nuclei of helium atoms
  + Beta particles- electrons traveling at high speeds
  + Gamma rays- high-energy electromagnetic radiation
  + Radionuclies- unstable atoms caused by the breaking of radioactive elements
  + Polonium- when radon decays because of radioactivity and looses an alpha particle
* **Measuring and Detecting Radioactivity**
  + Electroscope- commonly used to detect and measure small electrical charges
  + Geiger counter- a cigar-shaped tube made of glass and metal, with a wire running through it, connected to a storage battery and a loud speaker or amplifier used to detect radioactivity
  + Cloud chamber- where the paths of the particles that make up the radiation are photographed

* **Nuclear Fission**
  + Deuterons- the nuclei of hydrogen atoms containing a proton and a neutron
  + Nuclear reactor- a device used to control nuclear energy, also known as an atomic pile
* **Exploratory Activities**
  + Exploring properties of mixtures (grades 3-8)
    - Mixing substances and observing the separation in the mixture
  + Exploring properties of compounds(grades 3-8)
    - Physical and chemical changes
  + Exploring the properties of solutions(grades 4-8)
    - Solution stations (soluble, insoluble, and effects of temperature)